



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/600,008	06/18/2003	Paul C. Galambos	SD7357/S100432	6061
20567	7590	10/13/2004	EXAMINER	
SANDIA CORPORATION			GORDON, RAQUEL YVETTE	
P O BOX 5800			ART UNIT	PAPER NUMBER
MS-0161				2853
ALBUQUERQUE, NM 87185-0161				

DATE MAILED: 10/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

A4

Office Action Summary	Application No.	Applicant(s)
	10/600,008	GALAMBOS ET AL.
Examiner	Art Unit	
Raquel Y. Gordon	2853	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 6/18/2003 (this applications).
- 2a) This action is FINAL. 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-42 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) 23-42 is/are allowed.
- 6) Claim(s) 1-11, 13 and 14 is/are rejected.
- 7) Claim(s) 12 and 15-22 is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 18 June 2003 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All b) Some * c) None of:
 1. Certified copies of the priority documents have been received.
 2. Certified copies of the priority documents have been received in Application No. _____.
 3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)	4) <input type="checkbox"/> Interview Summary (PTO-413)
2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)	Paper No(s)/Mail Date. _____
3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>6/18/2003</u> .	5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)
	6) <input type="checkbox"/> Other: _____

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

For example, with respect to claims 1 and 14, it is unclear as to how the piston claimed is both inside a chamber and outside a chamber. For the purposes of examination, the claimed limitation "moveable in the plane of the substrate from a first position outside the fluid-ejection chamber" (claim 1) and "wherein the piston is located, at least in part, inside the fluid reservoir, and the actuator is located outside the fluid reservoir" (claim 14) will not be treated.

Claims 2-12, and 15-22 depend from rejected base claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 7-11 and 13, as best understood, are rejected under 35 U.S.C. 102(b) as being anticipated by Coleman et al. (US006318841B1).

Coleman et al. teach every element of the instant claims including:

1. A surface-micromachined fluid-ejection apparatus, comprising: (a) a substrate (22); (b) an open-ended cylindrical fluid-ejection chamber (24) formed on the substrate and further comprising a plurality of stacked and patterned layers of polycrystalline silicon (1800, 1950, 2100, col 6, Ins 24-44), with the fluid-ejection chamber (24) being adapted to receive a fluid (col 6, In 45-50), and with the fluid-ejection chamber further having a fluid-ejection orifice (92) formed through a wall (22A) thereof at a location distal to an open end of the fluid-ejection chamber; and (c) a piston (12) formed on the substrate (22) and moveable in the plane of the substrate to a second position inside the fluid-ejection chamber to eject a jet or drop of the fluid through the orifice (see fig 3);
2. The apparatus of Claim 1 further comprising a microelectromechanical actuator formed on the substrate and operatively connected to move the piston between the first and second positions (100, 200, 300, col 6, In 36-37, col 5, In 33-39);
3. The apparatus of Claim 2 wherein the actuator comprises an electrostatic actuator (col 6, In 38);
4. The apparatus of Claim 3 wherein the electrostatic actuator comprises a bidirectional electrostatic actuator to provide a reciprocating motion to the piston (springs 99A, 99B col 5, In 33-39),
7. The apparatus of Claim 2 further including another microelectromechanical actuator operatively connected to retract the piston after ejection of the fluid (col 6, In 54);
8. The apparatus of Claim 1 wherein the substrate comprises silicon (col 6, In 37);
9. The apparatus of Claim 1 wherein the piston comprises polycrystalline silicon (col 6, Ins 17-18);
10. The apparatus of Claim 1 further including a fluid reservoir in fluidic communication with the fluid-ejection chamber for providing the fluid thereto (see fig 3);
11. The apparatus of Claim 10 wherein the fluid-ejection chamber includes an opening through a sidewall thereof to provide a pathway for the fluid to enter the fluid-ejection chamber (col 6, In 45-50);

13. The apparatus of Claim 10 further including a fluid fill port formed through the substrate for supplying the fluid to the fluid reservoir (col 6, Ins 45-50).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coleman et al. in view of Delametter et al. (Pub No. US 2004/0036741 A1).

Coleman et al. teach every element of the instant claims except:

5. The apparatus of Claim 2 wherein the actuator comprises a thermal actuator;

6. The apparatus of Claim 5 wherein the thermal actuator comprises a bent-beam thermal actuator.

Nevertheless, Delametter et al. teach

5. The apparatus of Claim 2 wherein the actuator comprises a thermal actuator (15);

6. The apparatus of Claim 5 wherein the thermal actuator comprises a bent-beam thermal actuator (15).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Colemen et al. by the aforementioned teachings of Delametter et al. for the purposes of providing optimal actuation for ejection of ink, as taught by Delametter et al.

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Coleman et al.

Coleman et al. teach every element of the instant invention except Coleman et al. does not specifically teach the difference of:

21. The apparatus of Claim 1 wherein the fluid-ejection orifice has a diameter of 50 microns or less.

Nevertheless, Coleman et al. teach micro machined orifice 92. One of ordinary skill in the art at the time the invention was made would understand micromachined technology to such as that taught by Coleman et al. would result in microscopically sized apparatuses, as claimed.

It would have been obvious to one of ordinary skill in the invention, at the time the invention was made to modify Coleman et al. for the purpose of providing an optimally manufactured printhead.

Allowable Subject Matter

Claims 23-42 are allowed.

Claims 12, 15-22 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Reasons for Indication of Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter. As emphasized below with underlining and bold, the following claim combinations are not taught by the prior art:

12. The apparatus of Claim 11 wherein the sidewall of the fluid-ejection chamber is hollow and forms a fluid communication channel between the fluid reservoir and the fluid-ejection chamber;
15. The apparatus of Claim 14 wherein the piston is connected to the actuator by a linkage which penetrates through an opening in a sidewall of the fluid reservoir;
16. The apparatus of Claim 15 wherein the opening in the sidewall of the fluid reservoir further includes an indentation opposite each side of the linkage to provide a gas bubble seal between the linkage and the fluid reservoir to limit a leakage of the fluid through a gap separating the linkage and the opening in the sidewall of the fluid reservoir;
17. The apparatus of Claim 15 further including means for collecting any leakage of the fluid through a gap separating the linkage and the opening in the sidewall of the fluid reservoir;
18. The apparatus of Claim 17 wherein the means for collecting the leakage comprises a duct extending outward from the gap for conducting any leakage of the fluid away from the gap;

19. The apparatus of Claim 18 wherein the duct empties into a fluid evacuation port formed through the substrate;
20. The apparatus of Claim 18 wherein the duct empties into a fluid evaporation tank formed on the substrate;
22. The apparatus of Claim 1 wherein the fluid-ejection chamber comprises an electricfield-free region, with the piston and fluid-ejection chamber both being maintained at a ground electrical potential during ejection of the jet or drop of the fluid;
23. A surface-micromachined fluid-ejection apparatus, comprising: (a) a substrate; (b) an open-ended fluid-ejection chamber formed on the substrate from a plurality of stacked and patterned layers of polycrystalline silicon, with the fluid-ejection chamber being adapted to receive a fluid, and with the fluid-ejection chamber further having a fluid-ejection orifice formed through a wall thereof; (c) a fluid reservoir formed on the substrate from the plurality of stacked and patterned layers of polycrystalline silicon and connected to the fluid-ejection chamber to supply the fluid thereto; (d) a piston formed on the substrate and moveable in the plane of the substrate to eject a jet or drop of the fluid through the fluid-ejection orifice; and (e) at least one microelectromechanical actuator formed on the substrate and operatively connected to provide reciprocating motion to the piston, with the microelectromechanical actuator being located outside the fluid reservoir and outside the fluid-ejection chamber;
24. The apparatus of Claim 23 wherein a fluidic connection between the fluid reservoir and the fluid-ejection chamber is provided through the piston;
25. The apparatus of Claim 24 wherein the fluidic connection comprises a hollow portion of the piston and a flapper valve formed within the piston;
26. The apparatus of Claim 23 wherein a fluidic connection between the fluid reservoir and the fluid-ejection chamber is provided through a hollow sidewall of the fluid-ejection chamber;
27. The apparatus of Claim 23 wherein a fluidic connection between the fluid reservoir and the fluid-ejection chamber is provided through a spacing between the piston and an open end of the fluid-ejection chamber when the piston is in a retracted position;
28. The apparatus of Claim 23 wherein a mechanical connection between the microelectromechanical actuator and the piston is made through an opening in the sidewall of the fluid reservoir;

29. The apparatus of Claim 28 wherein the opening in the sidewall of the fluid reservoir further includes an indentation opposite each side of the linkage to provide a gasbubble seal between the linkage and the fluid reservoir to limit a leakage of the fluid through a gap separating the linkage and the opening in the sidewall of the fluid reservoir;
30. The apparatus of Claim 28 further including means for collecting any leakage of the fluid through a gap separating the linkage and the opening in the sidewall of the fluid reservoir;
31. The apparatus of Claim 30 wherein the means for collecting the comprises a duct extending outward from the gap for conducting any leakage of the fluid away from the gap;
32. The apparatus of Claim 31 wherein the duct empties into a fluid evacuation port formed through the substrate;
33. The apparatus of Claim 31 wherein the duct empties into a fluid evaporation tank formed on the substrate;
34. The apparatus of Claim 23 wherein the substrate comprises silicon, and the piston comprises polycrystalline silicon;
35. A surface-micromachined fluid-ejection apparatus, comprising: (a) a substrate; (b) an open-ended fluid-ejection chamber formed on the substrate, with the fluid-ejection chamber forming an electric-field-free region whereby a fluid disposed therein is not contacted by any electric field produced by the apparatus, and with the fluid-ejection chamber further having a micron-sized fluid-ejection orifice formed through a top wall thereof; (c) a fluid reservoir formed on the substrate and connected to the fluid-ejection chamber to supply the fluid thereto; (d) a piston formed on the substrate and moveable in the plane of the substrate to eject a portion of the fluid through the fluid-ejection orifice; and **(e) at least one microelectromechanical actuator formed on the substrate outside the fluid reservoir and operatively connected to provide reciprocating motion to the piston;**
36. The apparatus of Claim 35 wherein the substrate comprises monocrystalline silicon, and each of the fluid-ejection chamber, the fluid reservoir, the piston and the microelectromechanical actuator comprise polycrystalline silicon;
37. The apparatus of Claim 35 wherein the piston is connected to the microelectromechanical actuator by a linkage which penetrates through an opening in a sidewall of the fluid reservoir;

38. The apparatus of Claim 37 wherein the opening in the sidewall of the fluid reservoir further includes an indentation opposite each side of the linkage to provide a gasbubble seal between the linkage and the fluid chamber to limit a leakage of the fluid through a gap separating the linkage and the opening in the sidewall of the fluid reservoir;
39. The apparatus of Claim 37 further including means for collecting any leakage of the fluid through a gap separating the linkage and the opening in the sidewall of the fluid reservoir;
40. The apparatus of Claim 39 wherein the means for collecting the leakage comprises a duct extending outward from the gap for conducting any leakage of the fluid away from the gap;
41. The apparatus of Claim 40 wherein the duct empties into a fluid evacuation port formed through the substrate;
42. The apparatus of Claim 40 wherein the duct empties into a fluid evaporation tank formed on the substrate.

Contact Information

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Raquel Y. Gordon, whose telephone number is (571) 272-2145. The Examiner can normally be reached on M Tu Th and F 8:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the Examiner's supervisor, Stephen Meier can be reached on (571) 272-2149. A fax number is available upon request.

Any inquiry of a general nature or relating to the status of this application or proceeding may be directed to the Examiner or Supervisor.



Raquel Y. Gordon
Primary Examiner
Art Unit 2853
September 25, 2004

RAQUEL GORDON
PRIMARY EXAMINER